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memorandum

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APT Neutron Library for MCNP - Version 1

Abstract

APTN, the first MCNPTM neutron cross-section library based on 150-MeV APT evaluations performed in Group T-2 has been released. The library contains data for 15 nuclides, including ²H, C, ¹⁶O, ²⁷Al, and isotopes of Fe, W, and Pb. The data tables include complete information about the production of secondary charged particles and are ready for use in MCNPX,TM the prototype merged MCNP-LAHETTM code. This version of the library should *not* be used for detailed heating calculations, nor does it contain charged-particle production data for certain low-energy (< 20 MeV) neutron reactions.

Background

An important requirement of the ongoing transport code / nuclear data development for the Accelerator Production of Tritium (APT) Program is to develop the necessary tools to model transport of coupled neutral- and charged-particles below 150 MeV based on nuclear-data evaluations. The purpose of this document is to describe an MCNP¹ neutron cross-section library that helps to meet that objective.

Chadwick and Young in Group T-2 have completed several evaluations of neutron cross sections to 150 MeV for important APT materials (see, for example, Ref. 2 and other T-2 APT progress reports). These evaluations fully utilize the “n-particle” capabilities of the ENDF6 format;³ in particular, multiplicities and spectra of charged particles resulting from neutron interactions have been explicitly provided.

Since current MCNP neutron cross-section tables are limited to specifying secondary data for neutrons and photons only, an expanded format was defined⁴ to allow inclusion of secondary data for an arbitrary number of additional particles. The ADDCP code⁵ has been developed to read and process all appropriate secondary charged-particle data provided by an evaluation. The results are then added to a conventional MCNP data table.

Substantial modifications to MCNP are required to utilize such data. Therefore, an update

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patch to Version 4xq of MCNP that allows production of neutron-induced secondary charged particles using data contained on expanded continuous-energy neutron cross-section tables has been written, tested, and documented.⁶ This update patch has been incorporated by Hughes into the prototype merged code,⁷ (code that combines the capabilities of MCNP and LAHET⁸) which is called MCNPX.

This memo describes a neutron cross-section library for MCNP that builds on and unites the efforts described above.

Creation of Library

When this work was initiated, Young and Chadwick had completed 15 neutron evaluations. The 15 materials are listed in Table 1. Young and Chadwick have stored the ENDF-format files under the /t2/pgyu/apt/n CFS node. Files are named no16he2, nfe56he2, nw184he4, etc. Their latest evaluations for all nuclides except for the tungsten isotopes have names ending in “2;” the tungsten isotopes have file names ending in “4.” MacFarlane has also stored the evaluations under the /endf/apt node on the open CFS. It is these files that have been used in actual processing. These files are identical to the Young and Chadwick files with one exception. MacFarlane has corrected the ²⁷Al evaluation’s description of the cross section for MT=5 so that the threshold is 20.0 MeV, rather than the original 1.e-11 MeV.⁹ Information on the actual ENDF-format files used in processing is provided in Table 1.

Table 1: ENDF Format Files Used to Create APTN Library

Material	MAT	CFS File Under /endf/apt Node	Date File Last Written
H-2	128	h2	3/6/97
C	600	c12	12/19/96
O-16	825	o16	12/19/96
Al-27	1325	al27	3/25/97
Fe-54	2625	fe54	12/19/96
Fe-56	2631	fe56	12/19/96
Fe-57	2634	fe57	12/19/96
Fe-58	2637	fe58	12/19/96
W-182	7431	w182	3/5/97
W-183	7434	w183	3/5/97
W-184	7437	w184	3/5/97

Table 1: ENDF Format Files Used to Create APTN Library

Material	MAT	CFS File Under /endf/apt Node	Date File Last Written
W-186	7443	w186	3/5/97
Pb-206	8231	pb206	12/19/96
Pb-207	8234	pb207	12/19/96
Pb-208	8237	pb208	12/19/96

Our intended processing scheme for these neutron evaluations was to use existing, well-established NJOY¹⁰ capabilities to arrive at traditional (i.e., no secondary charged-particle data) MCNP data tables. Then, the ADDCP code would be used to post-process these traditional ACE files. Eventually, it is intended that the functionality of ADDCP will be added directly into NJOY.

The final NJOY processing of the 15 evaluations described in Table 1 was accomplished by MacFarlane. Many iterations on this work were required and several intermediate versions of NJOY were created along the way. Table II lists the versions of NJOY used for each evaluation to create the PENDF and ACE files as well information about the PENDF and ACE files themselves. All ENDF, PENDF, and ACE files listed in Tables 1 and 2, as well as the relevant NJOY input files, have been archived under the /090895/addcp/lib/archive node on CFS.

Table 2: PENDF Files, ACE Files, and NJOY Versions Used to Create APTN Library

Material	NJOY Version Used to Create PENDF File	CFS File Under /pendf/apt Node	Date PENDF File Last Written	NJOY Version Used to Create ACE File	CFS File Under /ace/apt Node	Date ACE File Last Written
H-2	94.68	h2	3/6/97	94.68	h2	3/6/97
C	94.69	c12	4/4/97	94.69	c12	4/7/97
O-16	94.69	o16	4/4/97	94.69	o16	4/7/97
Al-27	94.69	al27	4/4/97	94.69	al27	4/5/97
Fe-54	94.66	fe54	12/19/96	94.68	fe54	3/6/97
Fe-56	94.66	fe56	12/19/96	94.68	fe56	3/6/97
Fe-57	94.66	fe57	12/19/96	94.68	fe57	3/6/97
Fe-58	94.66	fe58	12/19/96	94.68	fe58	3/6/97

Table 2: PENDF Files, ACE Files, and NJOY Versions Used to Create APTN Library

Material	NJOY Version Used to Create PENDF File	CFS File Under /pendf/apt Node	Date PENDF File Last Written	NJOY Version Used to Create ACE File	CFS File Under /ace/apt Node	Date ACE File Last Written
W-182	94.68	w182	3/5/97	94.68	w182	3/6/97
W-183	94.68	w183	3/6/97	94.68	w183	3/6/97
W-184	94.68	w184	3/6/97	94.68	w184	3/6/97
W-186	94.68	w186	3/6/97	94.68	w186	3/6/97
Pb-206	94.66	pb206	12/19/96	94.68	pb206	3/6/97
Pb-207	94.66	pb207	12/19/96	94.68	pb207	3/6/97
Pb-208	94.66	pb208	12/19/96	94.68	pb208	3/25/97

These traditional ACE files from NJOY were then used as input (along with the corresponding ENDF files listed in Table 1) to ADDCP so that the neutron-induced charged-particle cross sections and spectra could be properly included. ADDCP Version 1.2 was used to prepare most of the data sets contained on the APTN library.

A slightly modified version of ADDCP (Version 1.2a, stored on CFS as /090895/addcp/addcp_1.2a.f) was required for the W isotopes, ^{206}Pb , and ^{208}Pb . Version 1.2a was necessary to handle some extremely small values (10^{-30} to 10^{-50}) of differential scattering probabilities found on the evaluations. These small values resulted in the inability to use the processed data on 32-bit platforms. Version 1.2a simply sets such values equal to 1.e-30 before further processing.

Description of Library

The nuclear-data processing described in the previous section has resulted in the MCNP data tables for the APTN library. Each of the 15 data tables has been assigned a ZAID ending in ‘.22c.’ The incident neutron energy range in all cases extends from 1.0e-11 to 150 MeV. A complete list of all neutron reactions available on the APTN library may be found in Appendix 1.

Table 3 indicates the secondary charged particles for which data are provided for each material on the APTN library. A blank entry indicates no neutron-induced charged-particle data for that particle. Threshold energies for particle production in Table 3 are given in MeV. No ^3He -production data were included on the T-2 evaluations. Any evaluated production data for particles other than isotopes of hydrogen and helium are currently ignored by ADDCP.

Table 3: Secondary Charged-Particle Data for Materials on the APTN Library

Material	ZAID	Proton-Prod Threshold	Deuteron-Prod Threshold	Triton-Prod Threshold	Alpha-Prod Threshold
H-2	1002.22c	3.339			
C	6000.22c	20.0	20.0		20.0
O-16	8016.22c	20.0	20.0		20.0
Al-27	13027.22c	1.897	6.274	11.29	3.247
Fe-54	26054.22c	0.7	20.0	20.0	3.0
Fe-56	26056.22c	2.966	20.0	20.0	0.862
Fe-57	26057.22c	1.943	20.0	20.0	0.8
Fe-58	26058.22c	5.249	20.0	20.0	1.423
W-182	74182.22c	20.0	20.0	20.0	20.0
W-183	74183.22c	20.0	20.0	20.0	20.0
W-184	74184.22c	20.0	20.0	20.0	20.0
W-186	74186.22c	20.0	20.0	20.0	20.0
Pb-206	82206.22c	20.0	20.0	20.0	20.0
Pb-207	82207.22c	20.0	20.0	20.0	20.0
Pb-208	82208.22c	4.236	5.816	6.403	1.0e-11

In Refs. 5 and 6 we indicate that ADDCP and MCNP have the capability to handle several ENDF6 representations of secondary energy-angle distributions for neutron-induced charged particles. All of the supported capabilities are required for at least one of the 15 isotopes on APTN. Specifically,

- Tabular energy distribution - Fe isotopes.
- Kalbach systematics for correlated energy-angle distributions - C, ^{16}O , ^{27}Al , Fe isotopes, W isotopes, Pb isotopes.
- N-Body phase-space energy distribution - ^2H .
- Discrete two-body scattering - ^{27}Al , ^{208}Pb .
- Anisotropic angular distributions via equally-probable cosine bins - ^{208}Pb .

In addition, multiple neutron reactions may contribute to the production of a specific secondary charged particle. This feature is required for ^{27}Al , the Fe isotopes, and ^{208}Pb . To illustrate the complexity involved, the ^{27}Al evaluation includes 27 different neutron reactions that contribute to alpha production.

Of perhaps incidental interest is the effect that incorporating all of the new charged-particle production data has had on the size of the data tables. This information is given for APTN in Table 4, where *length* is defined to be the total number of data entries on the table. As can be seen, the average increase in size of an MCNP data table that includes charged-particle production data compared to one without such data is approximately 30%. Of course, the actual increase in storage required for a particular MCNPX calculation is heavily problem dependent.

Table 4: Effect of New Charged-Particle Data on Size of MCNP Data Tables

Material	ZAID	Length Without Particle Production	Length With Particle Production	Percent Increase
H-2	1002.22c	3,887	4,177	7
C	6000.22c	39,777	59,641	50
O-16	8016.22c	80,773	98,393	22
Al-27	13027.22c	189,443	285,941	51
Fe-54	26054.22c	239,561	294,472	23
Fe-56	26056.22c	397,612	470,194	18
Fe-57	26057.22c	210,518	268,562	28
Fe-58	26058.22c	145,773	196,346	35
W-182	74182.22c	151,950	198,345	31
W-183	74183.22c	124,487	171,562	38
W-184	74184.22c	112,546	158,490	41
W-186	74186.22c	116,087	161,373	39
Pb-206	82206.22c	349,315	395,542	13
Pb-207	82207.22c	245,240	291,779	19
Pb-208	82208.22c	207,251	294,070	42
	total	2,614,220	3,348,887	28

Caveats

There are two limitations that users of the APTN library should be aware of. They relate to neutron heating and to “low-energy” charged-particle production. Each limitation will now be summarized.

MCNP uses neutron heating numbers when calculating energy deposition with an F6 tally. These heating numbers are energy-dependent quantities that represent the average energy deposited locally per neutron collision. Traditionally, the neutron heating numbers have accounted for the kinetic energies of the recoils and of any charged particles produced. The assumption has been that this energy is deposited locally. This assumption has been adequate so long as the induced charged particles have not been transported.

Now that the user will have the option of producing and transporting the charged particles, we need to address the issue of neutron heating. Our strategy was to leave unchanged the traditional neutron heating numbers. However, we will *also* include heating (energy production) information for each additional particle produced. Then, if MCNP is transporting a particular particle (e.g., a proton), the portion of total neutron heating attributable to secondary protons can be subtracted from the traditional heating numbers. [MCNP aficionados might correctly point out that this capability exceeds that which is currently available for the much simpler case of neutron-induced photon production. In this case, we have never made the necessary data available (nor does MCNP have the capability to use such data) to differentiate between neutron heating from a neutron-only problem and neutron heating from a coupled neutron-photon problem.]

The tables included on APTN have been prepared in such a manner that MCNPX is able to mechanically perform the appropriate adjustment to the neutron heating numbers. The caveat is that the “partial” heating values are currently all set to zero. The reason for this is that we decided not to duplicate development in ADDCP of some rather complicated coding; rather, to leave the task of calculating individual particle heating numbers for later NJOY development. This means, of course, that *this version of the APTN library should generally not be used for detailed heating calculations.*

The second caveat is that *not all evaluated neutron reactions that include charged particle reaction products have been incorporated* into the charged-particle production data found on APTN. This statement no doubt seems peculiar, and therefore warrants some explanation.

ADDCP includes in its calculation of the total particle production cross section only those reactions for which the evaluation explicitly includes complete information about the secondary spectra (energy, angle) of the particle. Such data are given in MF=6 of the evaluation. It is very possible that the evaluation will include additional reactions that produce the particle; for example, MT=103 (n,p) clearly produces a proton. However, if the evaluation of this reaction includes only the integrated cross section (MF=3) and no spectral information (MF=6), then it is essentially irrelevant (because the information is incomplete) for the purpose at hand, and ADDCP ignores it.

This difference is relevant to APTN because the new 150 MeV evaluations from T-2 are generally built “on-top” of an existing evaluation that typically extends to 20 MeV. Frequently, the existing evaluation below 20 MeV (and thus, the new T-2 evaluation below

20 MeV) will have no mechanism specified for producing distributions of secondary charged particles. As explained in the previous paragraph, such incomplete information is ignored by ADDCP. Table 5 provides a list of the charged-particle producing reactions that exist in the evaluations, but in an incomplete form. Of the 15 evaluations that comprise APTN, the most complete, in terms of charged-particle production spectra, are ^{27}Al and ^{208}Pb .

Table 5: Evaluated Reactions Having Incomplete Charged-Particle Production Data

Material	Secondary Particle	Reaction Identifiers (MTs)	Reaction Types
H-2	Triton	102	(n, γ)
C	Proton	28,103	(n,n')p, (n,p)
	Deuteron	104	(n,d)
	Alpha	52-62,91,107	(n,n')3 α , (n, α)
O-16	Proton	66,70,73,75,78,80,83,85,87,103	(n,n')p, (n,p)
	Deuteron	104	(n,d)
	Alpha	56-65,67-69,71,72,74,76,77,79,81,82,84,86,88,107	(n,n') α , (n, α)
Fe-54	Deuteron	104	(n,d)
Fe-56	Deuteron	104	(n,d)
	Triton	105	(n,t)
W isotopes	Proton	28,103	(n,n')p, (n,p)
	Alpha	107	(n, α)
Pb-206, Pb-207	Proton	103	(n,p)
	Triton	105	(n,t)
	Alpha	107	(n, α)

We believe that this limitation will have a rather minor effect on APT target calculations (or any calculations that emphasize neutron-induced particle production at energies greater than 20 MeV). There is, however, a mechanism that is currently available to the user to estimate how many neutron-induced charged particles are being “missed.” The creation and loss tables found in an MCNPX output file for each charged particle will include a creation entry labeled “tabular sampling.” Since we currently do not have tables for incident particles other than neutrons, the “tabular sampling” weight created repre-

sents the average number of this particle type created per source particle (over the entire problem geometry) from neutrons with energies less than 150 MeV (or whatever energy is specified to be the “cross-over” between LAHET physics models and data tables). Any incomplete reaction that was ignored by ADDCP would *not* contribute to this value.

The second method of calculating total neutron-induced particle production is to use the MCNP FM capability along with special total particle-production cross section edits created by the GASPR module of NJOY. For each relevant cell, users should make an F4 tally of neutron flux. Then, they should use an FM multiplier on that tally. The constant on the FM card should be the product of the atom density in that cell (atoms/[b cm]) and the volume of the cell (cm³). The material referenced on the FM card should obviously be the material in the cell. The reaction identifier should be the appropriate MT taken from Table 6. The result of this tally is the total number of neutron-induced particles in the cell (once again, from neutrons with energies in the tabular region being used). If necessary, sum the results over all relevant cells. The key point is that this result *will* include contributions from all reactions specified in the evaluation to produce the particle (incomplete or not). Any difference between this result and the one described in the previous paragraph indicates the “missing” charged particles. If a user finds this difference to be significant for a particular problem, please contact us.

Table 6: Reaction Identifiers for Total Particle Production Edits

Reaction MT	Reaction
203	total proton production
204	total deuteron production
205	total triton production
206	total ³ He production
207	total alpha production

Quality Assurance

Standard XTM procedures, as summarized in Reference 11, were followed in the quality assurance of the APTN library. The special-purpose checking codes described in Reference 11 reported nothing seriously amiss. There were numerous instances found where the scattered neutron energy could be greater than the incident neutron energy. However, the probability was always small, and the maximum possible artificial upscattering was generally ~1%. Since MCNP4B no longer aborts when this situation occurs, it was decided not to make any changes to the data.

Cross-section plots were created for each available reaction for all of the materials on the APTN library. The plots were reviewed and found to be generally reasonable. As previously pointed out,¹¹ the elastic scattering cross section for ⁵⁷Fe is nonsense in the ~0.5-1.0 MeV energy range. In addition, there are occasional discontinuities in cross sections at 20 MeV. The postscript file containing plots for each of the 692 neutron reactions on APTN is archived on CFS as /090895/addcp/lib/archive/plot.

NJOY internal consistency checks on the ACE file always reported “no problems found.” There were numerous NJOY “messages” found in both the PENDF and ACE output files; none are believed to indicate a serious problem.

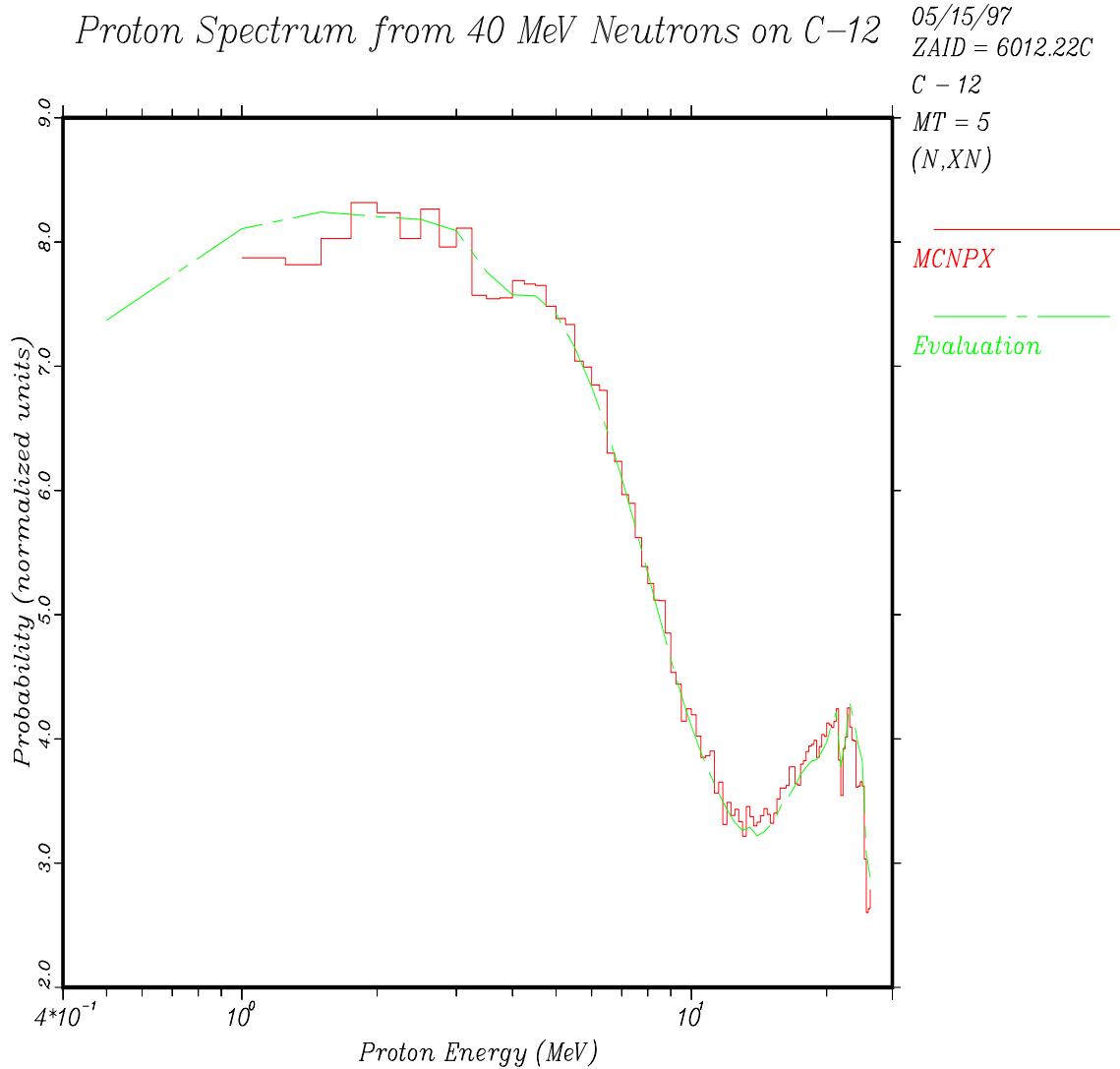
ADDCP creates a file that provides a summary of what happened during processing. These files have been reviewed and any possible problems have been resolved or understood. One valuable component of the ADDCP summary information is a point-by-point comparison of the NJOY-calculated total particle production cross sections and the ADDCP-calculated total particle production cross sections. All differences found between NJOY and ADDCP are due to the reasons discussed in the “Caveats” section above.

Various calculations have been performed with MCNPX and APTN to verify that the new physics capabilities associated with utilization of the 150-MeV neutron evaluations have been correctly processed in ADDCP and implemented in MCNPX. For example, we verified that the total particle-production cross sections were properly generated in ADDCP and correctly sampled in MCNPX by using the two independent methodologies described in the “Caveats” section to determine total neutron-induced charged-particle production (i.e., comparing the “tabular sampling” entry in the summary tables with appropriately constructed FM tallies). If one limits such a calculation to the neutron energy range where evaluated charged-particle data is “complete,” then the two sets of results should be consistent. Such a test problem was constructed. All 15 materials were included in the problem, and neutrons from 20-150 MeV were included. Results (secondary particles per source neutron), shown in Table 7, verify the total particle-production cross sections and secondary particle-production sampling algorithms.

Table 7: Verification of Particle-Production Data and Sampling Algorithms

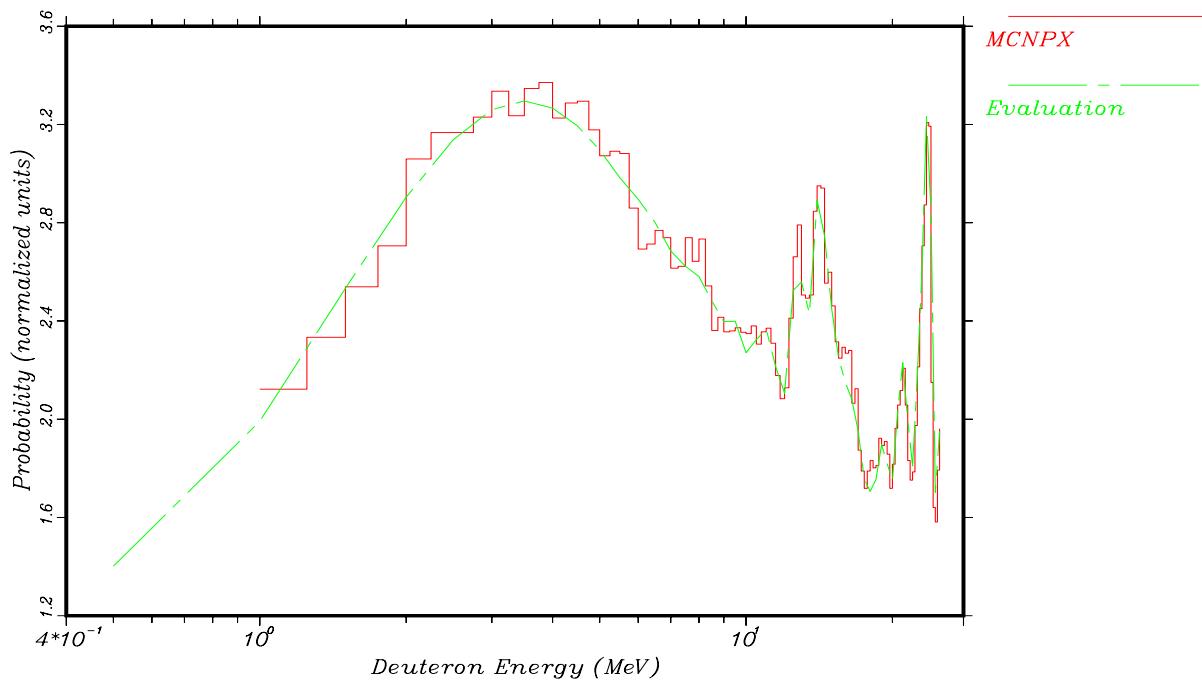
	FM Method	Actual Particle Production	Ratio
protons	0.5334	0.5326	0.999
deuterons	0.0545	0.0548	1.006
tritons	0.0074	0.0072	0.980
alphas	0.1272	0.1275	1.003

Next, calculations were performed to verify some of the algorithms used to sample secondary-particle spectra. The test calculations had a monoenergetic neutron source impinging on a very thin slab of a single material. The forced neutron collision capability of MCNPX was utilized to create secondary particles; the leakage spectra of these particles were then tallied. Calculated results were compared with spectra derived from the original evaluation. Such comparisons are shown in the following three figures for protons, deuterons, and alphas produced by 40-MeV neutrons impinging on a thin slab of carbon. The plots verify that ADDCP has correctly processed the evaluated spectral data and that MCNPX has correctly sampled the secondary energies.

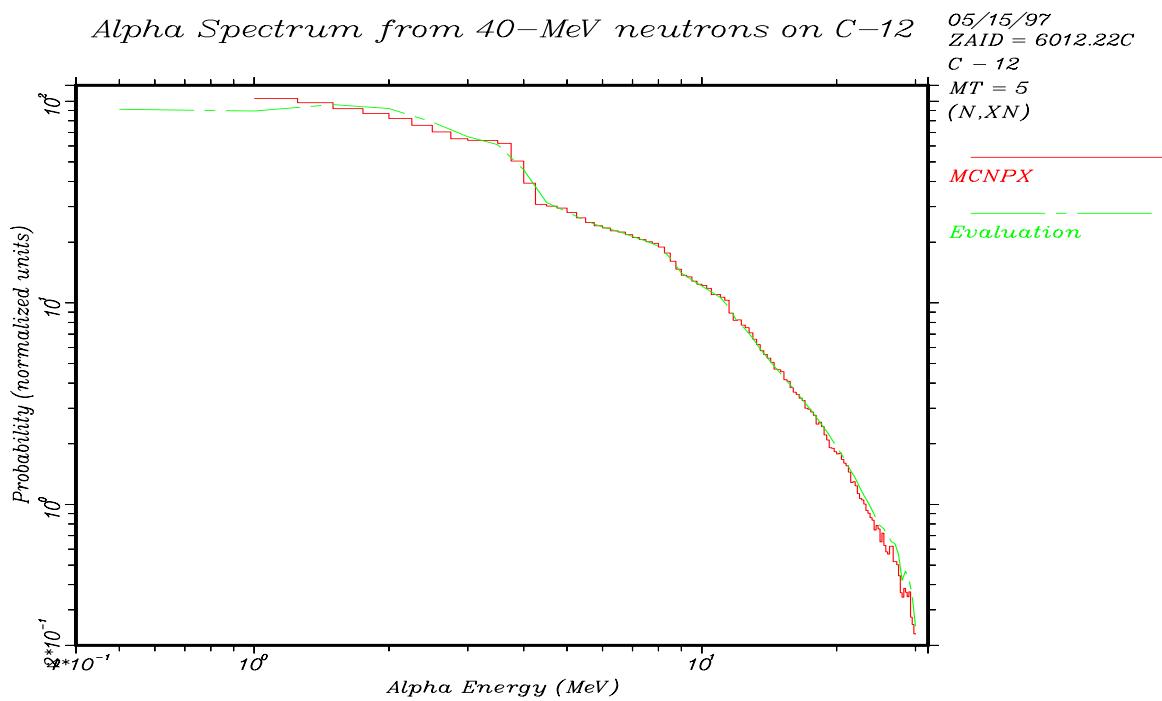


05/15/97
 ZAID = 6012.22C
 C - 12
 MT = 5

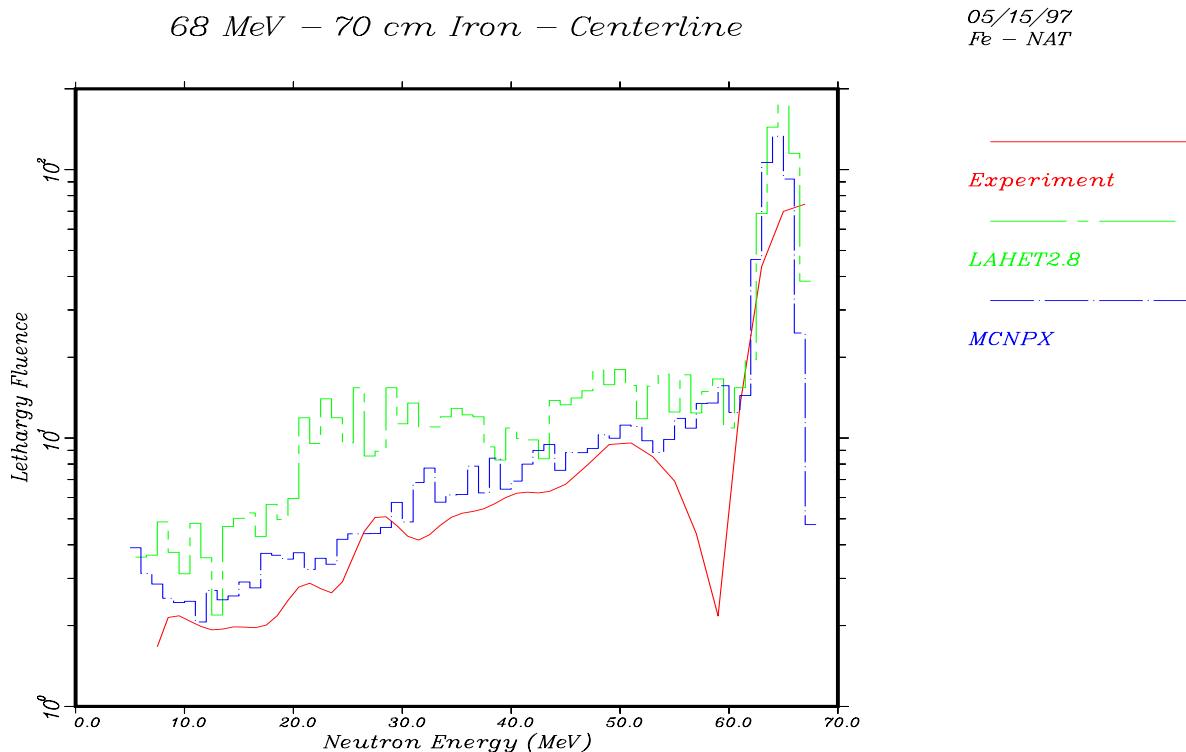
Deuteron Spectrum from 40-MeV neutrons on C-12(N,XN)



Alpha Spectrum from 40-MeV neutrons on C-12



Finally, preliminary calculations of an integral experiment have been performed with MCNPX and the APTN cross-section library. We have simulated a recent measurement of the transmission of quasi-monoenergetic neutrons generated by 68-MeV protons through 70 cm of iron.¹² An MCNP model of the experiment had been previously generated¹³ to benchmark LAHET 2.8. Results of recalculating this configuration are compared with experiment and LAHET 2.8 results in the figure below. It is clear that results using MCNPX and the APTN library are in better qualitative agreement with experiment than are the LAHET 2.8 results.



Library Availability

Type-1 and Type-2 versions of the APTN library are stored on open CFS as indicated in Table 8. In addition to certain code developers and data developers in XTM and T-2, access to these files is currently available to the following users: Phil Ferguson, Eric Pitcher, Gary Russell, and Laurie Waters. Others requiring access should contact the author.

The directory files include entries for *only* the data tables found on the APTN library. To use a combination of APTN data with other data libraries, the appropriate lines from the relevant APTN directory file must be added to the user's current xsdir file. Also, in order to use the type-2 directories listed in Table 8, the user must change the name of the directory to something with no more than eight characters (for example, change aptn2.xs.unix to aptn2.xs. before actually using with MCNPX).

Table 8: Open CFS Files for APTN Library

CFS File	Description
/x6data/ce/special/apt/aptn1	Type-1 Library
/x6data/ce/special/apt/aptn1.xs	Directory for aptn1
/x6data/ce/special/apt/aptn2.ucos	Type-2 Library for UNICOS
/x6data/ce/special/apt/aptn2.xs.ucos	Directory for aptn2.ucos
/x6data/ce/special/apt/aptn2.unix	Type-2 Library for UNIX
/x6data/ce/special/apt/aptn2.xs.unix	Directory for aptn2.unix

Of course, to take complete advantage of the charged-particle production data in APTN, the MCNPX code must be used. As indicated in Ref. 7, to use the APTN data up to its maximum neutron energy, the user must set the third entry on the PHYS:N card equal to 150.

The APTN library may be used with versions of MCNP that do not have the capability to produce secondary charged particles, such as the current production version, MCNP4B.¹⁴ In such cases, the neutron-induced charged particle data will simply be ignored.

Summary and Future Plans

In summary, the initial version of the APTN library has been produced. APTN is the first continuous-energy MCNP neutron library to include comprehensive neutron-induced charged-particle production data. Cross sections for 15 materials are provided on APTN, based on 150-MeV evaluations from T-2. The library is compatible with the prototype version of the merged MCNP-LAHET code, called MCNPX.

Future work will include more complete documentation of the benchmarking of APTN and MCNPX. In addition, we will add cross sections for new materials to APTN as the evaluations become available from T-2. Finally, of course, significant work remains to be done to include the capability of using tabular data in MCNPX for incident charged particles.

Acknowledgments:

It is a pleasure to acknowledge the assistance of several colleagues who contributed greatly to this work. Stephanie Frankle defined the expanded MCNP format for neutron-induced charged-particle data and was helpful in many of the ongoing efforts to produce the APTN library. Grady Hughes' work to incorporate the companion MCNP patch into MCNPX was essential. He also provided substantial guidance with the use of MCNPX. Bob MacFarlane made several corrections to NJOY and did the final NJOY processing. Mark Chadwick and Phil Young consulted substantially on the neutron evaluations; Mark also made available some extra information to facilitate a portion of the QA process. Tom Evans and Nolan Hertel (Georgia Tech) provided the MCNP problem setup for the Japanese benchmark experiment as well as the experimental and LAHET 2.8 results.

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Appendix 1
Listing of Neutron Reaction Data on APTN

Table 9: H-2 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,2n)	16	-2	1	-1	1	3.3393E+00	1.5000E+02	-2.2250E+00
(n,gma)	102	0	127			1.0000E-11	1.5000E+02	6.2574E+00
(n,xp)	203	0	390			3.3393E+00	1.5000E+02	
(n,xt)	205	0	516			1.0000E-11	1.5000E+02	
damage	444	0	779			1.0000E-11	1.5000E+02	

Table 10: C Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	41	2.0000E+01	1.5000E+02	0.0000E+00
(n,n*)p	28	1	122	0	7207	1.7298E+01	1.5000E+02	-1.5957E+01
(n,n*1)	51	-1	280	7424	7227	4.8121E+00	1.5000E+02	-4.4390E+00
(n,n*2)	52	-1	823	10332	7238	8.2962E+00	1.5000E+02	-7.6530E+00
(n,n*3)	53	-1	1190	10615	7249	1.0448E+01	1.5000E+02	-9.6380E+00
(n,n*4)	54	-1	1481	0	7260	1.1708E+01	1.5000E+02	-1.0800E+01
(n,n*5)	55	-1	1745	0	7271	1.2792E+01	1.5000E+02	-1.1800E+01
(n,n*6)	56	-1	1986	0	7282	1.3767E+01	1.5000E+02	-1.2700E+01
(n,n*7)	57	-1	2210	0	7293	1.4500E+01	1.5000E+02	-1.3350E+01
(n,n*8)	58	-1	2423	0	7304	1.5263E+01	1.5000E+02	-1.4080E+01
(n,n*9)	59	-1	2609	0	7315	1.6347E+01	1.5000E+02	-1.5080E+01
(n,n*10)	60	-1	2781	0	7326	1.7431E+01	1.5000E+02	-1.6080E+01
(n,n*11)	61	-1	2935	0	7337	1.8516E+01	1.5000E+02	-1.7080E+01
(n,n*12)	62	-1	3074	0	7348	1.9600E+01	1.5000E+02	-1.8080E+01
(n,n*c)	91	1	3199	0	7359	7.8864E+00	1.5000E+02	-7.2750E+00

Table 10: C Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,gma)	102	0	3595			1.0000E-11	1.5000E+02	4.9470E+00
(n,p)	103	0	4643			1.4472E+01	1.5000E+02	-1.2588E+01
(n,d)	104	0	4857			1.5263E+01	1.5000E+02	-1.3733E+01
(n,a)	107	0	5044			6.1812E+00	1.5000E+02	-5.7020E+00
(n,xp)	203	0	5522			1.4472E+01	1.5000E+02	
(n,xd)	204	0	5736			1.5263E+01	1.5000E+02	
(n,xa)	207	0	5923			6.1812E+00	1.5000E+02	
damage	444	0	6401			1.0000E-11	1.5000E+02	

Table 11: O-16 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	41	2.0000E+01	1.5000E+02	0.0000E+00
(n,n*1)	51	-1	123	25556	5752	6.4310E+00	1.5000E+02	-6.0494E+00
(n,n*2)	52	-1	742	26329	5763	6.5166E+00	1.5000E+02	-6.1299E+00
(n,n*3)	53	-1	1348	27102	5774	7.3534E+00	1.5000E+02	-6.9171E+00
(n,n*4)	54	-1	1872	27700	5785	7.5658E+00	1.5000E+02	-7.1168E+00
(n,n*5)	55	-1	2375	28298	5796	9.4315E+00	1.5000E+02	-8.8719E+00
(n,n*6)	56	-1	2780	0	5807	1.0190E+01	1.5000E+02	-9.5850E+00
(n,n*7)	57	-1	3161	0	5818	1.0465E+01	1.5000E+02	-9.8445E+00
(n,n*8)	58	-1	3529	0	5829	1.1009E+01	1.5000E+02	-1.0356E+01
(n,n*9)	59	-1	3852	0	5840	1.1648E+01	1.5000E+02	-1.0957E+01
(n,n*10)	60	-1	4161	0	5851	1.1779E+01	1.5000E+02	-1.1080E+01
(n,n*11)	61	-1	4465	0	5862	1.1797E+01	1.5000E+02	-1.1097E+01
(n,n*12)	62	-1	4766	0	5873	1.1970E+01	1.5000E+02	-1.1260E+01
(n,n*13)	63	-1	5061	0	5884	1.2247E+01	1.5000E+02	-1.1520E+01

Table 11: O-16 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,n*14)	64	-1	5350	0	5895	1.2332E+01	1.5000E+02	-1.1600E+01
(n,n*15)	65	-1	5636	0	5906	1.2809E+01	1.5000E+02	-1.2049E+01
(n,n*16)	66	-1	5908	0	5917	1.3225E+01	1.5000E+02	-1.2440E+01
(n,n*17)	67	-1	6169	0	5928	1.3320E+01	1.5000E+02	-1.2530E+01
(n,n*18)	68	-1	6426	0	5939	1.3603E+01	1.5000E+02	-1.2796E+01
(n,n*19)	69	-1	6678	0	5950	1.3787E+01	1.5000E+02	-1.2969E+01
(n,n*20)	70	-1	6909	0	5961	1.3979E+01	1.5000E+02	-1.3150E+01
(n,n*21)	71	-1	7125	0	5972	1.4298E+01	1.5000E+02	-1.3450E+01
(n,n*22)	72	-1	7336	0	5983	1.4617E+01	1.5000E+02	-1.3750E+01
(n,n*23)	73	-1	7541	0	5994	1.4936E+01	1.5000E+02	-1.4050E+01
(n,n*24)	74	-1	7741	0	6005	1.5255E+01	1.5000E+02	-1.4350E+01
(n,n*25)	75	-1	7934	0	6016	1.5574E+01	1.5000E+02	-1.4650E+01
(n,n*26)	76	-1	8122	0	6027	1.5893E+01	1.5000E+02	-1.4950E+01
(n,n*27)	77	-1	8305	0	6038	1.6212E+01	1.5000E+02	-1.5250E+01
(n,n*28)	78	-1	8483	0	6049	1.6531E+01	1.5000E+02	-1.5550E+01
(n,n*29)	79	-1	8657	0	6060	1.6850E+01	1.5000E+02	-1.5850E+01
(n,n*30)	80	-1	8826	0	6071	1.7169E+01	1.5000E+02	-1.6150E+01
(n,n*31)	81	-1	8991	0	6082	1.7488E+01	1.5000E+02	-1.6450E+01
(n,n*32)	82	-1	9151	0	6093	1.7807E+01	1.5000E+02	-1.6750E+01
(n,n*33)	83	-1	9305	0	6104	1.8125E+01	1.5000E+02	-1.7050E+01
(n,n*34)	84	-1	9455	0	6115	1.8444E+01	1.5000E+02	-1.7350E+01
(n,n*35)	85	-1	9600	0	6126	1.8763E+01	1.5000E+02	-1.7650E+01
(n,n*36)	86	-1	9740	0	6137	1.9082E+01	1.5000E+02	-1.7950E+01
(n,n*37)	87	-1	9875	0	6148	1.9401E+01	1.5000E+02	-1.8250E+01
(n,n*38)	88	-1	10004	0	6159	1.9720E+01	1.5000E+02	-1.8550E+01
(n,gma)	102	0	10128			1.0000E-11	1.5000E+02	4.1434E+00
(n,p)	103	0	11863			1.0245E+01	1.5000E+02	-9.6368E+00

Table 11: O-16 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,d)	104	0	12240			1.0528E+01	1.5000E+02	-9.9030E+00
(n,a)	107	0	12603			2.3554E+00	1.5000E+02	-2.2156E+00
(n,xp)	203	0	14012			1.0245E+01	1.5000E+02	
(n,xd)	204	0	14389			1.0528E+01	1.5000E+02	
(n,xa)	207	0	14752			2.3554E+00	1.5000E+02	
damage	444	0	16161			1.0000E-11	1.5000E+02	
(n,a*0)	800	0	17896			2.3554E+00	1.5000E+02	-2.2156E+00
(n,a*1)	801	0	19305			5.6396E+00	1.5000E+02	-5.3050E+00
(n,a*2)	802	0	20106			6.2723E+00	1.5000E+02	-5.9001E+00
(n,a*3)	803	0	20744			6.4523E+00	1.5000E+02	-6.0694E+00

Table 12: Al-27 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	-2	158	-1	11031	1.3546E+01	1.5000E+02	-1.3058E+01
(n,n*)a	22	-1	373	-1	15527	1.0467E+01	1.5000E+02	-1.0090E+01
(n,n*)p	28	-1	638	-1	20801	8.5814E+00	1.5000E+02	-8.2721E+00
(n,n*)d	32	-1	925	-1	27252	1.7781E+01	1.5000E+02	-1.7140E+01
(n,n*)t	33	-1	1097	-1	30232	1.8894E+01	1.5000E+02	-1.8214E+01
(n,x)	45	-1	1261	-1	32987	1.9590E+01	1.5000E+02	-1.8884E+01
(n,n*1)	51	-1	1420	2242	35263	8.7529E-01	1.5000E+02	-8.4375E-01
(n,n*2)	52	-1	2773	2809	35274	1.0524E+00	1.5000E+02	-1.0144E+00
(n,n*3)	53	-1	4032	3376	35285	2.2938E+00	1.5000E+02	-2.2111E+00
(n,n*4)	54	-1	4896	3943	35296	2.8370E+00	1.5000E+02	-2.7348E+00
(n,n*5)	55	-1	5651	4226	35307	3.0925E+00	1.5000E+02	-2.9811E+00
(n,n*6)	56	-1	6362	4548	35318	3.1163E+00	1.5000E+02	-3.0040E+00

Table 12: Al-27 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,n*7)	57	-1	7067	0	35329	3.8177E+00	1.5000E+02	-3.6801E+00
(n,n*8)	58	-1	7672	4870	35340	4.1047E+00	1.5000E+02	-3.9568E+00
(n,n*9)	59	-1	8246	5089	35351	4.2059E+00	1.5000E+02	-4.0543E+00
(n,n*10)	60	-1	8806	5308	35362	4.5751E+00	1.5000E+02	-4.4102E+00
(n,n*11)	61	-1	9332	5492	35373	4.6789E+00	1.5000E+02	-4.5103E+00
(n,n*12)	62	-1	9847	5676	35384	4.7512E+00	1.5000E+02	-4.5800E+00
(n,n*13)	63	-1	10356	5860	35395	4.9916E+00	1.5000E+02	-4.8117E+00
(n,n*14)	64	-1	10844	0	35406	5.3491E+00	1.5000E+02	-5.1563E+00
(n,n*15)	65	-1	11306	0	35417	5.4444E+00	1.5000E+02	-5.2482E+00
(n,n*16)	66	-1	11760	0	35428	5.6225E+00	1.5000E+02	-5.4199E+00
(n,n*17)	67	-1	12199	0	35439	5.6359E+00	1.5000E+02	-5.4328E+00
(n,n*18)	68	-1	12637	0	35450	5.6417E+00	1.5000E+02	-5.4384E+00
(n,n*19)	69	-1	13074	0	35461	5.7054E+00	1.5000E+02	-5.4998E+00
(n,n*20)	70	-1	13507	0	35472	5.7582E+00	1.5000E+02	-5.5507E+00
(n,n*21)	71	-1	13937	0	35483	5.8789E+00	1.5000E+02	-5.6670E+00
(n,n*22)	72	-1	14355	0	35494	5.9663E+00	1.5000E+02	-5.7513E+00
(n,n*23)	73	-1	14766	0	35505	6.0446E+00	1.5000E+02	-5.8268E+00
(n,n*24)	74	-1	15173	0	35516	6.1824E+00	1.5000E+02	-5.9596E+00
(n,n*25)	75	-1	15570	0	35527	6.3073E+00	1.5000E+02	-6.0800E+00
(n,n*26)	76	-1	15957	0	35538	6.3440E+00	1.5000E+02	-6.1154E+00
(n,n*27)	77	-1	16342	0	35549	6.3895E+00	1.5000E+02	-6.1592E+00
(n,n*28)	78	-1	16725	0	35560	6.5220E+00	1.5000E+02	-6.2870E+00
(n,n*29)	79	-1	17099	0	35571	6.7056E+00	1.5000E+02	-6.4640E+00
(n,n*30)	80	-1	17462	0	35582	6.7194E+00	1.5000E+02	-6.4773E+00
(n,n*31)	81	-1	17824	0	35593	6.7552E+00	1.5000E+02	-6.5118E+00
(n,n*32)	82	-1	18182	0	35604	6.7772E+00	1.5000E+02	-6.5330E+00
(n,n*33)	83	-1	18539	0	35615	6.8522E+00	1.5000E+02	-6.6053E+00

Table 12: Al-27 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,n*34)	84	-1	18889	0	35626	6.9002E+00	1.5000E+02	-6.6515E+00
(n,n*35)	85	-1	19236	0	35637	6.9640E+00	1.5000E+02	-6.7130E+00
(n,n*36)	86	-1	19578	0	35648	7.0179E+00	1.5000E+02	-6.7650E+00
(n,n*37)	87	-1	19915	0	35659	7.0287E+00	1.5000E+02	-6.7754E+00
(n,n*38)	88	-1	20251	0	35670	7.0689E+00	1.5000E+02	-6.8142E+00
(n,n*39)	89	-1	20582	0	35681	7.0750E+00	1.5000E+02	-6.8200E+00
(n,n*c)	91	-1	20911	-1	35692	7.0750E+00	1.5000E+02	-6.8200E+00
(n,gma)	102	0	21240			1.0000E-11	1.5000E+02	7.7252E+00
(n,p)	103	0	23624			1.8969E+00	1.5000E+02	-1.8285E+00
(n,d)	104	0	24599			6.2736E+00	1.5000E+02	-6.0475E+00
(n,t)	105	0	24989			1.1290E+01	1.5000E+02	-1.0883E+01
(n,a)	107	0	25238			3.2474E+00	1.5000E+02	-3.1303E+00
(n,2a)	108	0	25920			1.4480E+01	1.5000E+02	-1.3958E+01
(n,2p)	111	0	26121			1.7428E+01	1.5000E+02	-1.6800E+01
(n,pa)	112	0	26296			1.4195E+01	1.5000E+02	-1.3684E+01
(n,da)	117	0	26503			1.7282E+01	1.5000E+02	-1.6659E+01
(n,xp)	203	0	26681			1.8969E+00	1.5000E+02	
(n,xd)	204	0	27656			6.2736E+00	1.5000E+02	
(n,xt)	205	0	28046			1.1290E+01	1.5000E+02	
(n,xa)	207	0	28295			3.2474E+00	1.5000E+02	
damage	444	0	28977			1.0000E-11	1.5000E+02	
(n,p*0)	600	0	31361			1.8969E+00	1.5000E+02	-1.8285E+00
(n,p*1)	601	0	32336			2.9184E+00	1.5000E+02	-2.8132E+00
(n,p*2)	602	0	33075			3.6584E+00	1.5000E+02	-3.5265E+00
(n,p*3)	603	0	33703			3.9094E+00	1.5000E+02	-3.7685E+00
(n,p*4)	604	0	34296			5.1225E+00	1.5000E+02	-4.9379E+00
(n,p*5)	605	0	34776			5.4519E+00	1.5000E+02	-5.2554E+00

Table 12: Al-27 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,p*6)	606	0	35229			5.5021E+00	1.5000E+02	-5.3038E+00
(n,p*7)	607	0	35678			5.5181E+00	1.5000E+02	-5.3192E+00
(n,p*8)	608	0	36125			5.6000E+00	1.5000E+02	-5.3877E+00
(n,p*9)	609	0	36566			5.7979E+00	1.5000E+02	-5.5889E+00
(n,p*10)	610	0	36993			5.8243E+00	1.5000E+02	-5.6144E+00
(n,p*11)	611	0	37417			5.9261E+00	1.5000E+02	-5.7125E+00
(n,p*12)	612	0	37830			6.2018E+00	1.5000E+02	-5.9783E+00
(n,p*13)	613	0	38225			6.4595E+00	1.5000E+02	-6.2267E+00
(n,p*14)	614	0	38604			6.6199E+00	1.5000E+02	-6.3813E+00
(n,p*15)	615	0	38972			6.8516E+00	1.5000E+02	-6.6046E+00
(n,p*16)	616	0	39323			6.9047E+00	1.5000E+02	-6.6558E+00
(n,p*17)	617	0	39669			7.0758E+00	1.5000E+02	-6.8208E+00
(n,p*18)	618	0	39997			7.1129E+00	1.5000E+02	-6.8565E+00
(n,p*19)	619	0	40322			7.2623E+00	1.5000E+02	-7.0006E+00
(n,p*c)	649	0	40640			7.2623E+00	1.5000E+02	-7.0006E+00
(n,d*0)	650	0	40958			6.2736E+00	1.5000E+02	-6.0475E+00
(n,d*1)	651	0	41348			8.1499E+00	1.5000E+02	-7.8562E+00
(n,d*2)	652	0	41643			9.3218E+00	1.5000E+02	-8.9859E+00
(n,d*3)	653	0	41922			9.9961E+00	1.5000E+02	-9.6358E+00
(n,d*4)	654	0	42195			1.0361E+01	1.5000E+02	-9.9880E+00
(n,d*5)	655	0	42462			1.0753E+01	1.5000E+02	-1.0366E+01
(n,d*6)	656	0	42723			1.0767E+01	1.5000E+02	-1.0379E+01
(n,d*7)	657	0	42982			1.0786E+01	1.5000E+02	-1.0397E+01
(n,d*8)	658	0	43240			1.1289E+01	1.5000E+02	-1.0882E+01
(n,d*9)	659	0	43491			1.1357E+01	1.5000E+02	-1.0948E+01
(n,d*10)	660	0	43738			1.1432E+01	1.5000E+02	-1.1020E+01
(n,d*11)	661	0	43983			1.1762E+01	1.5000E+02	-1.1338E+01

Table 12: Al-27 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,d*12)	662	0	44225			1.1952E+01	1.5000E+02	-1.1521E+01
(n,d*13)	663	0	44464			1.2176E+01	1.5000E+02	-1.1738E+01
(n,d*14)	664	0	44701			1.2203E+01	1.5000E+02	-1.1763E+01
(n,d*15)	665	0	44936			1.2628E+01	1.5000E+02	-1.2173E+01
(n,d*16)	666	0	45165			1.2763E+01	1.5000E+02	-1.2304E+01
(n,d*17)	667	0	45393			1.3142E+01	1.5000E+02	-1.2669E+01
(n,d*18)	668	0	45617			1.3270E+01	1.5000E+02	-1.2792E+01
(n,d*19)	669	0	45839			1.3408E+01	1.5000E+02	-1.2925E+01
(n,d*c)	699	0	46058			1.3408E+01	1.5000E+02	-1.2925E+01
(n,t*0)	700	0	46277			1.1290E+01	1.5000E+02	-1.0883E+01
(n,t*1)	701	0	46526			1.1897E+01	1.5000E+02	-1.1468E+01
(n,t*2)	702	0	46766			1.2301E+01	1.5000E+02	-1.1858E+01
(n,t*3)	703	0	46999			1.2962E+01	1.5000E+02	-1.2495E+01
(n,t*4)	704	0	47225			1.3328E+01	1.5000E+02	-1.2848E+01
(n,t*5)	705	0	47446			1.3949E+01	1.5000E+02	-1.3447E+01
(n,t*6)	706	0	47657			1.4130E+01	1.5000E+02	-1.3621E+01
(n,t*7)	707	0	47866			1.4196E+01	1.5000E+02	-1.3684E+01
(n,t*8)	708	0	48072			1.4831E+01	1.5000E+02	-1.4288E+01
(n,t*9)	709	0	48267			1.4831E+01	1.5000E+02	-1.4297E+01
(n,t*10)	710	0	48462			1.5344E+01	1.5000E+02	-1.4791E+01
(n,t*c)	749	0	48653			1.5344E+01	1.5000E+02	-1.4791E+01
(n,a*0)	800	0	48844			3.2474E+00	1.5000E+02	-3.1303E+00
(n,a*1)	801	0	49526			3.7373E+00	1.5000E+02	-3.6026E+00
(n,a*2)	802	0	50140			3.8317E+00	1.5000E+02	-3.6936E+00
(n,a*3)	803	0	50743			4.6421E+00	1.5000E+02	-4.4717E+00
(n,a*4)	804	0	51263			4.6421E+00	1.5000E+02	-4.4748E+00
(n,a*5)	805	0	51783			4.6442E+00	1.5000E+02	-4.4768E+00

Table 12: Al-27 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,a*6)	806	0	52302			4.8164E+00	1.5000E+02	-4.6429E+00
(n,a*7)	807	0	52805			5.1625E+00	1.5000E+02	-4.9764E+00
(n,a*8)	808	0	53282			5.2033E+00	1.5000E+02	-5.0158E+00
(n,a*9)	809	0	53756			5.8547E+00	1.5000E+02	-5.6437E+00
(n,a*10)	810	0	54176			5.9200E+00	1.5000E+02	-5.6928E+00
(n,a*11)	811	0	54590			6.2596E+00	1.5000E+02	-6.0340E+00
(n,a*12)	812	0	54982			6.3365E+00	1.5000E+02	-6.1081E+00
(n,a*13)	813	0	55368			6.5844E+00	1.5000E+02	-6.3471E+00
(n,a*14)	814	0	55739			6.7453E+00	1.5000E+02	-6.5022E+00
(n,a*15)	815	0	56099			6.7884E+00	1.5000E+02	-6.5437E+00
(n,a*16)	816	0	56455			6.9706E+00	1.5000E+02	-6.7194E+00
(n,a*17)	817	0	56796			7.0115E+00	1.5000E+02	-6.7588E+00
(n,a*18)	818	0	57134			7.0405E+00	1.5000E+02	-6.7868E+00
(n,a*19)	819	0	57467			7.0667E+00	1.5000E+02	-6.8120E+00
(n,a*c)	849	0	57799			7.0667E+00	1.5000E+02	-6.8120E+00

Table 13: Fe-54 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	157	13899	11146	1.3630E+01	1.5000E+02	-1.3380E+01
(n,n*)a	22	1	328	14077	16337	8.5757E+00	1.5000E+02	-8.4183E+00
(n,n*)p	28	1	516	14325	23559	9.0175E+00	1.5000E+02	-8.8520E+00
(n,n*1)	51	-1	701	14643	33475	1.4343E+00	1.5000E+02	-1.4080E+00
(n,n*2)	52	-1	1498	14926	33486	2.5855E+00	1.5000E+02	-2.5380E+00
(n,n*3)	53	-1	1865	0	33497	2.6089E+00	1.5000E+02	-2.5610E+00
(n,n*4)	54	-1	2229	15174	33508	3.0052E+00	1.5000E+02	-2.9500E+00

Table 13: Fe-54 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,n*5)	55	-1	2556	15422	33519	3.0143E+00	1.5000E+02	-2.9590E+00
(n,n*6)	56	-1	2881	15670	33530	3.2252E+00	1.5000E+02	-3.1660E+00
(n,n*7)	57	-1	3193	15918	33541	3.3566E+00	1.5000E+02	-3.2950E+00
(n,n*c)	91	1	3496	16166	33552	3.4076E+00	1.5000E+02	-3.3450E+00
(n,gma)	102	0	3794			1.0000E-11	1.5000E+02	9.2986E+00
(n,p)	103	0	18603			7.0000E-01	1.5000E+02	8.5300E-02
(n,d)	104	0	20352			6.7540E+00	1.5000E+02	-6.6300E+00
(n,a)	107	0	20564			3.0000E+00	1.5000E+02	8.4300E-01
(n,xp)	203	0	20892			7.0000E-01	1.5000E+02	
(n,xd)	204	0	22641			6.7540E+00	1.5000E+02	
(n,xt)	205	0	22853			2.0000E+01	1.5000E+02	
(n,xa)	207	0	23009			3.0000E+00	1.5000E+02	
damage	444	0	23337			1.0000E-11	1.5000E+02	

Table 14: Fe-56 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	162	13899	11246	1.1402E+01	1.5000E+02	-1.1200E+01
(n,n*)a	22	1	407	14845	34421	7.7472E+00	1.5000E+02	-7.6100E+00
(n,n*)p	28	1	713	15546	55562	1.0364E+01	1.5000E+02	-1.0180E+01
(n,n*1)	51	-1	974	16492	79451	8.6227E-01	1.5000E+02	-8.4700E-01
(n,n*2)	52	-1	3752	17265	79462	2.1226E+00	1.5000E+02	-2.0850E+00
(n,n*3)	53	-1	4758	17513	79473	2.7059E+00	1.5000E+02	-2.6580E+00
(n,n*4)	54	-1	5573	17691	79484	2.9951E+00	1.5000E+02	-2.9420E+00
(n,n*5)	55	-1	6323	18079	79495	3.0134E+00	1.5000E+02	-2.9600E+00
(n,n*6)	56	-1	7067	18292	79506	3.1763E+00	1.5000E+02	-3.1200E+00

Table 14: Fe-56 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,n*7)	57	-1	7772	18575	79517	3.1793E+00	1.5000E+02	-3.1230E+00
(n,n*8)	58	-1	8474	18823	79528	3.4308E+00	1.5000E+02	-3.3700E+00
(n,n*9)	59	-1	9125	19001	79539	3.4491E+00	1.5000E+02	-3.3880E+00
(n,n*10)	60	-1	9771	19319	79550	3.5071E+00	1.5000E+02	-3.4450E+00
(n,n*11)	61	-1	10409	19567	79561	3.5112E+00	1.5000E+02	-3.4490E+00
(n,n*12)	62	-1	11046	19850	79572	3.6670E+00	1.5000E+02	-3.6020E+00
(n,n*13)	63	-1	11662	20203	79583	3.6720E+00	1.5000E+02	-3.6070E+00
(n,n*14)	64	-1	12274	20381	79594	3.8237E+00	1.5000E+02	-3.7560E+00
(n,n*15)	65	-1	12860	20664	79605	3.9011E+00	1.5000E+02	-3.8320E+00
(n,n*16)	66	-1	13433	20842	79616	3.9266E+00	1.5000E+02	-3.8570E+00
(n,n*17)	67	-1	14000	21055	79627	4.1220E+00	1.5000E+02	-4.0490E+00
(n,n*18)	68	-1	14542	21303	79638	4.1739E+00	1.5000E+02	-4.1000E+00
(n,n*19)	69	-1	15077	21551	79649	4.1943E+00	1.5000E+02	-4.1200E+00
(n,n*20)	70	-1	15607	21799	79660	4.3755E+00	1.5000E+02	-4.2980E+00
(n,n*21)	71	-1	16111	22012	79671	4.3796E+00	1.5000E+02	-4.3020E+00
(n,n*22)	72	-1	16612	22225	79682	4.4743E+00	1.5000E+02	-4.3950E+00
(n,n*23)	73	-1	17099	22438	79693	4.4804E+00	1.5000E+02	-4.4010E+00
(n,n*24)	74	-1	17583	22651	79704	4.5384E+00	1.5000E+02	-4.4580E+00
(n,n*25)	75	-1	18060	22864	79715	4.5913E+00	1.5000E+02	-4.5100E+00
(n,n*c)	91	1	18530	23112	79726	4.6209E+00	1.5000E+02	-4.5390E+00
(n,gma)	102	0	18993			1.0000E-11	1.5000E+02	7.8030E+00
(n,p)	103	0	38738			2.9655E+00	1.5000E+02	-2.9130E+00
(n,d)	104	0	39495			8.1025E+00	1.5000E+02	-7.9590E+00
(n,t)	105	0	39795			1.2143E+01	1.5000E+02	-1.1928E+01
(n,he3)	106	0	40032			1.0720E+01	1.5000E+02	-1.0530E+01
(n,a)	107	0	40285			8.6227E-01	1.5000E+02	3.2600E-01
(n,xp)	203	0	43064			2.9655E+00	1.5000E+02	

Table 14: Fe-56 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,xd)	204	0	43821			8.1025E+00	1.5000E+02	
(n,xt)	205	0	44121			1.2143E+01	1.5000E+02	
(n,xhe3)	206	0	44358			1.0720E+01	1.5000E+02	
(n,xa)	207	0	44611			8.6227E-01	1.5000E+02	
damage	444	0	47390			1.0000E-11	1.5000E+02	

Table 15: Fe-57 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	155	0	11401	7.7815E+00	1.5000E+02	-7.6460E+00
(n,n*)a	22	1	374	0	13220	7.4499E+00	1.5000E+02	-7.3202E+00
(n,n*)p	28	1	599	0	14277	1.0746E+01	1.5000E+02	-1.0559E+01
(n,n*1)	51	-1	798	0	15190	1.4248E-02	1.5000E+02	-1.4000E-02
(n,n*2)	52	-1	11283	0	15201	1.3943E-01	1.5000E+02	-1.3700E-01
(n,n*3)	53	-1	17767	0	15212	3.7350E-01	1.5000E+02	-3.6700E-01
(n,n*4)	54	-1	21463	0	15223	7.1851E-01	1.5000E+02	-7.0600E-01
(n,n*5)	55	-1	24304	0	15234	1.0248E+00	1.5000E+02	-1.0070E+00
(n,n*c)	91	1	26480	0	15245	1.1601E+00	1.5000E+02	-1.1399E+00
(n,gma)	102	0	28370			1.0000E-11	1.5000E+02	1.0044E+01
(n,p)	103	0	40118			1.9428E+00	1.5000E+02	-1.9090E+00
(n,a)	107	0	41130			8.0000E-01	1.5000E+02	2.4000E+00
(n,xp)	203	0	43831			1.9428E+00	1.5000E+02	
(n,xd)	204	0	44843			2.0000E+01	1.5000E+02	
(n,xt)	205	0	44997			2.0000E+01	1.5000E+02	
(n,xa)	207	0	45151			8.0000E-01	1.5000E+02	

Table 15: Fe-57 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
damage	444	0	47852			1.0000E-11	1.5000E+02	

Table 16: Fe-58 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	162	0	11246	1.0219E+01	1.5000E+02	-1.0044E+01
(n,n*)a	22	1	377	0	12417	7.7785E+00	1.5000E+02	-7.6454E+00
(n,n*)p	28	1	604	0	13402	1.2161E+01	1.5000E+02	-1.1953E+01
(n,n*1)	51	-1	795	0	14123	8.2512E-01	1.5000E+02	-8.1100E-01
(n,n*2)	52	-1	3485	0	14134	1.7042E+00	1.5000E+02	-1.6750E+00
(n,n*c)	91	1	4685	0	14145	2.1124E+00	1.5000E+02	-2.0763E+00
(n,gma)	102	0	5610			1.0000E-11	1.5000E+02	6.5810E+00
(n,p)	103	0	14724			5.2488E+00	1.5000E+02	-5.1590E+00
(n,a)	107	0	15057			1.4234E+00	1.5000E+02	-1.3990E+00
(n,xp)	203	0	16516			5.2488E+00	1.5000E+02	
(n,xd)	204	0	16849			2.0000E+01	1.5000E+02	
(n,xt)	205	0	17010			2.0000E+01	1.5000E+02	
(n,xa)	207	0	17171			1.4234E+00	1.5000E+02	
damage	444	0	18630			1.0000E-11	1.5000E+02	

Table 17: W-182 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	159	1509	11496	8.1071E+00	1.5000E+02	-8.0624E+00

Table 17: W-182 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,3n)	17	3	351	1615	12610	1.4829E+01	1.5000E+02	-1.4747E+01
(n,n*)p	28	1	521	0	12843	1.1500E+01	1.5000E+02	-7.0920E+00
(n,n*1)	51	-1	699	1721	12911	1.0060E-01	1.5000E+02	-1.0005E-01
(n,n*2)	52	-1	1095	2352	12922	3.3080E-01	1.5000E+02	-3.2898E-01
(n,n*3)	53	-1	1442	2983	12933	6.8380E-01	1.5000E+02	-6.8003E-01
(n,n*4)	54	-1	1722	3268	12944	1.1420E+00	1.5000E+02	-1.1357E+00
(n,n*5)	55	-1	1989	3483	12955	1.1508E+00	1.5000E+02	-1.1445E+00
(n,n*6)	56	-1	2254	3698	12966	1.2290E+00	1.5000E+02	-1.2222E+00
(n,n*7)	57	-1	2517	3843	12977	1.2650E+00	1.5000E+02	-1.2580E+00
(n,n*8)	58	-1	2779	3988	12988	1.2960E+00	1.5000E+02	-1.2889E+00
(n,n*9)	59	-1	3039	4203	12999	1.3380E+00	1.5000E+02	-1.3306E+00
(n,n*10)	60	-1	3297	4348	13010	1.3780E+00	1.5000E+02	-1.3704E+00
(n,n*11)	61	-1	3554	4528	13021	1.4480E+00	1.5000E+02	-1.4400E+00
(n,n*12)	62	-1	3809	4708	13032	1.4950E+00	1.5000E+02	-1.4868E+00
(n,n*13)	63	-1	4062	4888	13043	1.5180E+00	1.5000E+02	-1.5096E+00
(n,n*14)	64	-1	4313	5068	13054	1.5620E+00	1.5000E+02	-1.5534E+00
(n,n*15)	65	-1	4562	5248	13065	1.6310E+00	1.5000E+02	-1.6220E+00
(n,n*16)	66	-1	4809	5428	13076	1.6420E+00	1.5000E+02	-1.6329E+00
(n,n*17)	67	-1	5055	5643	13087	1.6700E+00	1.5000E+02	-1.6608E+00
(n,n*18)	68	-1	5299	5823	13098	1.7210E+00	1.5000E+02	-1.7115E+00
(n,n*19)	69	-1	5541	5968	13109	1.7680E+00	1.5000E+02	-1.7583E+00
(n,n*c)	91	1	5781	6148	13120	3.0000E-01	1.5000E+02	-2.9835E-01
(n,gma)	102	0	6136			1.0000E-11	1.5000E+02	6.1904E+00
(n,p)	103	0	18576			1.0500E+01	1.5000E+02	-1.0286E+00
(n,a)	107	0	18758			1.1000E+01	1.5000E+02	7.8805E+00
(n,xp)	203	0	18938			1.0500E+01	1.5000E+02	
(n,xd)	204	0	19120			2.0000E+01	1.5000E+02	

Table 17: W-182 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,xt)	205	0	19278			2.0000E+01	1.5000E+02	
(n,xa)	207	0	19436			1.1000E+01	1.5000E+02	
damage	444	0	19616			1.0000E-11	1.5000E+02	

Table 18: W-183 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	159	1474	11521	6.2246E+00	1.5000E+02	-6.1904E+00
(n,3n)	17	3	352	1615	13043	1.4332E+01	1.5000E+02	-1.4253E+01
(n,n*)p	28	1	523	0	13288	1.1500E+01	1.5000E+02	-7.2190E+00
(n,n*1)	51	-1	702	1721	13368	4.7260E-02	1.5000E+02	-4.7001E-02
(n,n*2)	52	-1	996	2317	13379	9.9550E-02	1.5000E+02	-9.9004E-02
(n,n*3)	53	-1	1282	2983	13390	2.0810E-01	1.5000E+02	-2.0696E-01
(n,n*4)	54	-1	1558	3544	13401	2.1020E-01	1.5000E+02	-2.0905E-01
(n,n*5)	55	-1	1832	3724	13412	2.9360E-01	1.5000E+02	-2.9199E-01
(n,n*6)	56	-1	2099	3939	13423	3.1070E-01	1.5000E+02	-3.0900E-01
(n,n*7)	57	-1	2363	4570	13434	3.1120E-01	1.5000E+02	-3.0949E-01
(n,n*8)	58	-1	2626	4820	13445	4.1430E-01	1.5000E+02	-4.1203E-01
(n,n*9)	59	-1	2882	5035	13456	4.5550E-01	1.5000E+02	-4.5300E-01
(n,n*10)	60	-1	3135	5250	13467	4.8970E-01	1.5000E+02	-4.8701E-01
(n,n*11)	61	-1	3385	5570	13478	5.5710E-01	1.5000E+02	-5.5405E-01
(n,n*12)	62	-1	3630	5750	13489	6.0330E-01	1.5000E+02	-5.9999E-01
(n,n*13)	63	-1	3871	5930	13500	6.2340E-01	1.5000E+02	-6.1998E-01
(n,n*14)	64	-1	4110	6215	13511	7.4410E-01	1.5000E+02	-7.4002E-01
(n,n*c)	91	1	4342	6500	13522	7.4410E-01	1.5000E+02	-7.4002E-01

Table 18: W-183 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,gma)	102	0	4574			1.0000E-11	1.5000E+02	7.4114E+00
(n,p)	103	0	13862			1.0000E+01	1.5000E+02	-2.8600E-01
(n,a)	107	0	14044			1.1000E+01	1.5000E+02	9.0785E+00
(n,xp)	203	0	14224			1.0000E+01	1.5000E+02	
(n,xd)	204	0	14406			2.0000E+01	1.5000E+02	
(n,xt)	205	0	14564			2.0000E+01	1.5000E+02	
(n,xa)	207	0	14722			1.1000E+01	1.5000E+02	
damage	444	0	14902			1.0000E-11	1.5000E+02	

Table 19: W-184 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	157	1509	11491	7.4521E+00	1.5000E+02	-7.4114E+00
(n,3n)	17	3	351	1615	12738	1.3677E+01	1.5000E+02	-1.3602E+01
(n,n*)p	28	1	520	0	13057	1.2000E+01	1.5000E+02	-7.7000E+00
(n,n*1)	51	-1	694	1721	13137	1.1180E-01	1.5000E+02	-1.1119E-01
(n,n*2)	52	-1	1093	2387	13148	3.6605E-01	1.5000E+02	-3.6405E-01
(n,n*3)	53	-1	1441	2948	13159	7.5243E-01	1.5000E+02	-7.4833E-01
(n,n*4)	54	-1	1724	3198	13170	9.0824E-01	1.5000E+02	-9.0329E-01
(n,n*5)	55	-1	2000	3343	13181	1.0080E+00	1.5000E+02	-1.0025E+00
(n,n*6)	56	-1	2273	3558	13192	1.0120E+00	1.5000E+02	-1.0065E+00
(n,n*7)	57	-1	2544	3738	13203	1.1281E+00	1.5000E+02	-1.1219E+00
(n,n*8)	58	-1	2812	3918	13214	1.1361E+00	1.5000E+02	-1.1299E+00
(n,n*9)	59	-1	3078	4098	13225	1.1400E+00	1.5000E+02	-1.1338E+00
(n,n*10)	60	-1	3342	4278	13236	1.2281E+00	1.5000E+02	-1.2214E+00

Table 19: W-184 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,n*11)	61	-1	3603	4493	13247	1.2920E+00	1.5000E+02	-1.2850E+00
(n,n*12)	62	-1	3862	4708	13258	1.3011E+00	1.5000E+02	-1.2940E+00
(n,n*13)	63	-1	4118	4958	13269	1.3290E+00	1.5000E+02	-1.3218E+00
(n,n*14)	64	-1	4372	5173	13280	1.3521E+00	1.5000E+02	-1.3447E+00
(n,n*15)	65	-1	4624	5388	13291	1.3661E+00	1.5000E+02	-1.3586E+00
(n,n*16)	66	-1	4874	5603	13302	1.3941E+00	1.5000E+02	-1.3865E+00
(n,n*17)	67	-1	5122	5783	13313	1.4331E+00	1.5000E+02	-1.4253E+00
(n,n*18)	68	-1	5367	5928	13324	1.4390E+00	1.5000E+02	-1.4312E+00
(n,n*c)	91	1	5610	6108	13335	5.0000E-01	1.5000E+02	-4.9727E-01
(n,gma)	102	0	5930			1.0000E-11	1.5000E+02	5.7544E+00
(n,p)	103	0	13453			1.0500E+01	1.5000E+02	-2.0836E+00
(n,a)	107	0	13633			1.1000E+01	1.5000E+02	7.3620E+00
(n,xp)	203	0	13811			1.0500E+01	1.5000E+02	
(n,xd)	204	0	13991			2.0000E+01	1.5000E+02	
(n,xt)	205	0	14147			2.0000E+01	1.5000E+02	
(n,xa)	207	0	14303			1.1000E+01	1.5000E+02	
damage	444	0	14481			1.0000E-11	1.5000E+02	

Table 20: W-186 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	156	1509	11486	7.2386E+00	1.5000E+02	-7.1995E+00
(n,3n)	17	3	352	1615	12797	1.3024E+01	1.5000E+02	-1.2954E+01
(n,n*)p	28	1	522	0	13170	1.3000E+01	1.5000E+02	-8.4270E+00
(n,n*1)	51	-1	695	1721	13246	1.2300E-01	1.5000E+02	-1.2234E-01

Table 20: W-186 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
(n,n*2)	52	-1	1094	2352	13257	3.9870E-01	1.5000E+02	-3.9655E-01
(n,n*3)	53	-1	1436	2913	13268	7.4153E-01	1.5000E+02	-7.3753E-01
(n,n*4)	54	-1	1720	3093	13279	8.1294E-01	1.5000E+02	-8.0855E-01
(n,n*5)	55	-1	1999	3343	13290	8.6654E-01	1.5000E+02	-8.6187E-01
(n,n*6)	56	-1	2275	3523	13301	8.8684E-01	1.5000E+02	-8.8206E-01
(n,n*7)	57	-1	2549	3773	13312	9.5765E-01	1.5000E+02	-9.5248E-01
(n,n*8)	58	-1	2819	3953	13323	1.0111E+00	1.5000E+02	-1.0056E+00
(n,n*9)	59	-1	3086	4098	13334	1.0210E+00	1.5000E+02	-1.0155E+00
(n,n*10)	60	-1	3351	4278	13345	1.0371E+00	1.5000E+02	-1.0315E+00
(n,n*11)	61	-1	3614	4458	13356	1.0511E+00	1.5000E+02	-1.0454E+00
(n,n*12)	62	-1	3875	4638	13367	1.1560E+00	1.5000E+02	-1.1498E+00
(n,n*13)	63	-1	4133	4853	13378	1.2860E+00	1.5000E+02	-1.2791E+00
(n,n*14)	64	-1	4388	5033	13389	1.2911E+00	1.5000E+02	-1.2841E+00
(n,n*15)	65	-1	4641	5213	13400	1.3050E+00	1.5000E+02	-1.2980E+00
(n,n*16)	66	-1	4891	5393	13411	1.3261E+00	1.5000E+02	-1.3189E+00
(n,n*17)	67	-1	5139	5573	13422	1.4710E+00	1.5000E+02	-1.4631E+00
(n,n*18)	68	-1	5384	5718	13433	1.5280E+00	1.5000E+02	-1.5198E+00
(n,n*c)	91	1	5626	5863	13444	3.0000E-01	1.5000E+02	-2.9838E-01
(n,gma)	102	0	5989			1.0000E-11	1.5000E+02	5.4661E+00
(n,p)	103	0	13936			1.1500E+01	1.5000E+02	-3.1156E+00
(n,a)	107	0	14113			1.1000E+01	1.5000E+02	6.4175E+00
(n,xp)	203	0	14292			1.1500E+01	1.5000E+02	
(n,xd)	204	0	14469			2.0000E+01	1.5000E+02	
(n,xt)	205	0	14624			2.0000E+01	1.5000E+02	
(n,xa)	207	0	14779			1.1000E+01	1.5000E+02	
damage	444	0	14958			1.0000E-11	1.5000E+02	

Table 21: Pb-206 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	153	1581	11401	8.1253E+00	1.5000E+02	-8.0857E+00
(n,3n)	17	3	421	2422	38950	1.4889E+01	1.5000E+02	-1.4816E+01
(n,n*1)	51	-1	606	2668	45691	8.0693E-01	1.5000E+02	-8.0300E-01
(n,n*2)	52	-1	4317	3161	45702	1.1808E+00	1.5000E+02	-1.1750E+00
(n,n*3)	53	-1	5329	3584	45713	1.3476E+00	1.5000E+02	-1.3410E+00
(n,n*4)	54	-1	6204	3937	45724	1.4692E+00	1.5000E+02	-1.4620E+00
(n,n*5)	55	-1	6994	4360	45735	1.6902E+00	1.5000E+02	-1.6820E+00
(n,n*6)	56	-1	7668	4748	45746	1.7083E+00	1.5000E+02	-1.7000E+00
(n,n*7)	57	-1	8329	5101	45757	1.7706E+00	1.5000E+02	-1.7620E+00
(n,n*8)	58	-1	8957	5454	45768	2.0078E+00	1.5000E+02	-1.9980E+00
(n,n*9)	59	-1	9498	5772	45779	2.1706E+00	1.5000E+02	-2.1600E+00
(n,n*10)	60	-1	10027	6125	45790	2.2108E+00	1.5000E+02	-2.2000E+00
(n,n*11)	61	-1	10551	6478	45801	2.2208E+00	1.5000E+02	-2.2100E+00
(n,n*12)	62	-1	11072	6831	45812	2.2610E+00	1.5000E+02	-2.2500E+00
(n,n*13)	63	-1	11588	7184	45823	2.3967E+00	1.5000E+02	-2.3850E+00
(n,n*14)	64	-1	12091	7467	45834	2.5122E+00	1.5000E+02	-2.5000E+00
(n,n*15)	65	-1	12583	7785	45845	2.5384E+00	1.5000E+02	-2.5260E+00
(n,n*16)	66	-1	13073	8068	45856	2.6469E+00	1.5000E+02	-2.6340E+00
(n,n*17)	67	-1	13551	8491	45867	2.7966E+00	1.5000E+02	-2.7830E+00
(n,n*18)	68	-1	14012	8739	45878	2.8137E+00	1.5000E+02	-2.8000E+00
(n,n*19)	69	-1	14470	8987	45889	2.8338E+00	1.5000E+02	-2.8200E+00
(n,n*20)	70	-1	14925	9235	45900	2.9544E+00	1.5000E+02	-2.9400E+00
(n,n*21)	71	-1	15371	9483	45911	3.0318E+00	1.5000E+02	-3.0170E+00
(n,n*22)	72	-1	15809	9766	45922	3.0649E+00	1.5000E+02	-3.0500E+00
(n,n*23)	73	-1	16244	10049	45933	3.1403E+00	1.5000E+02	-3.1250E+00

Table 21: Pb-206 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,n*24)	74	-1	16669	10332	45944	3.2157E+00	1.5000E+02	-3.2000E+00
(n,n*25)	75	-1	17085	10615	45955	3.2659E+00	1.5000E+02	-3.2500E+00
(n,n*26)	76	-1	17491	10863	45966	3.2961E+00	1.5000E+02	-3.2800E+00
(n,n*27)	77	-1	17894	11111	45977	3.3162E+00	1.5000E+02	-3.3000E+00
(n,n*28)	78	-1	18293	11359	45988	3.4207E+00	1.5000E+02	-3.4040E+00
(n,n*29)	79	-1	18684	11607	45999	3.4699E+00	1.5000E+02	-3.4530E+00
(n,n*30)	80	-1	19069	11820	46010	3.5171E+00	1.5000E+02	-3.5000E+00
(n,n*31)	81	-1	19447	12033	46021	3.5774E+00	1.5000E+02	-3.5600E+00
(n,n*32)	82	-1	19816	12246	46032	3.6176E+00	1.5000E+02	-3.6000E+00
(n,n*33)	83	-1	20180	12459	46043	3.7262E+00	1.5000E+02	-3.7080E+00
(n,n*34)	84	-1	20535	12742	46054	3.7392E+00	1.5000E+02	-3.7210E+00
(n,n*35)	85	-1	20888	13060	46065	3.7684E+00	1.5000E+02	-3.7500E+00
(n,n*36)	86	-1	21237	13378	46076	3.7945E+00	1.5000E+02	-3.7760E+00
(n,n*37)	87	-1	21585	13696	46087	3.9191E+00	1.5000E+02	-3.9000E+00
(n,n*38)	88	-1	21924	13839	46098	3.9804E+00	1.5000E+02	-3.9610E+00
(n,n*39)	89	-1	22259	13982	46109	4.0246E+00	1.5000E+02	-4.0050E+00
(n,n*c)	91	1	22589	14125	46120	4.0698E+00	1.5000E+02	-4.0500E+00
(n,gma)	102	0	22916			1.0000E-11	1.5000E+02	6.7331E+00
(n,p)	103	0	45962			1.0000E+00	1.5000E+02	-7.4200E-01
(n,t)	105	0	47138			6.3520E+00	1.5000E+02	-6.3210E+00
(n,a)	107	0	47421			1.0000E+00	1.5000E+02	7.1220E+00
(n,xp)	203	0	48597			1.0000E+00	1.5000E+02	
(n,xd)	204	0	49773			2.0000E+01	1.5000E+02	
(n,xt)	205	0	49925			6.3520E+00	1.5000E+02	
(n,xa)	207	0	50208			1.0000E+00	1.5000E+02	
damage	444	0	51384			1.0000E-11	1.5000E+02	

Table 22: Pb-207 Neutron Reaction Data

reaction	mt	tyr	lsig	land	ldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	57	2.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	2	152	1581	11441	6.7658E+00	1.5000E+02	-6.7330E+00
(n,3n)	17	3	440	2632	46001	1.4889E+01	1.5000E+02	-1.4817E+01
(n,n*1)	51	-1	624	2878	52640	5.7278E-01	1.5000E+02	-5.7000E-01
(n,n*2)	52	-1	1769	3231	52651	9.0238E-01	1.5000E+02	-8.9800E-01
(n,n*3)	53	-1	2701	3514	52662	1.6410E+00	1.5000E+02	-1.6330E+00
(n,n*4)	54	-1	3290	3832	52673	2.3514E+00	1.5000E+02	-2.3400E+00
(n,n*5)	55	-1	3764	4080	52684	2.6368E+00	1.5000E+02	-2.6240E+00
(n,n*6)	56	-1	4219	4468	52695	2.6750E+00	1.5000E+02	-2.6620E+00
(n,n*7)	57	-1	4670	4856	52706	2.7393E+00	1.5000E+02	-2.7260E+00
(n,n*8)	58	-1	5118	5279	52717	3.0719E+00	1.5000E+02	-3.0570E+00
(n,n*9)	59	-1	5551	5492	52728	3.1955E+00	1.5000E+02	-3.1800E+00
(n,n*10)	60	-1	5974	5705	52739	3.2176E+00	1.5000E+02	-3.2020E+00
(n,n*11)	61	-1	6393	5918	52750	3.2377E+00	1.5000E+02	-3.2220E+00
(n,n*12)	62	-1	6809	6131	52761	3.2829E+00	1.5000E+02	-3.2670E+00
(n,n*13)	63	-1	7221	6309	52772	3.3141E+00	1.5000E+02	-3.2980E+00
(n,n*14)	64	-1	7629	6487	52783	3.3985E+00	1.5000E+02	-3.3820E+00
(n,n*15)	65	-1	8031	6665	52794	3.4256E+00	1.5000E+02	-3.4090E+00
(n,n*16)	66	-1	8428	6843	52805	3.4427E+00	1.5000E+02	-3.4260E+00
(n,n*17)	67	-1	8823	7021	52816	3.4879E+00	1.5000E+02	-3.4710E+00
(n,n*18)	68	-1	9214	7234	52827	3.5161E+00	1.5000E+02	-3.4990E+00
(n,n*19)	69	-1	9602	7447	52838	3.5201E+00	1.5000E+02	-3.5030E+00
(n,n*20)	70	-1	9989	7660	52849	3.5392E+00	1.5000E+02	-3.5220E+00
(n,n*21)	71	-1	10374	7873	52860	3.5974E+00	1.5000E+02	-3.5800E+00
(n,n*22)	72	-1	10753	8086	52871	3.6376E+00	1.5000E+02	-3.6200E+00

Table 22: Pb-207 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,n*23)	73	-1	11126	8334	52882	3.6497E+00	1.5000E+02	-3.6320E+00
(n,n*24)	74	-1	11498	8582	52893	3.6628E+00	1.5000E+02	-3.6450E+00
(n,n*25)	75	-1	11868	8830	52904	3.7432E+00	1.5000E+02	-3.7250E+00
(n,n*26)	76	-1	12230	9148	52915	3.8356E+00	1.5000E+02	-3.8170E+00
(n,n*27)	77	-1	12587	9466	52926	3.8728E+00	1.5000E+02	-3.8540E+00
(n,n*28)	78	-1	12942	9609	52937	3.9100E+00	1.5000E+02	-3.8910E+00
(n,n*29)	79	-1	13293	9752	52948	4.0084E+00	1.5000E+02	-3.9890E+00
(n,n*30)	80	-1	13637	9895	52959	4.0597E+00	1.5000E+02	-4.0400E+00
(n,n*31)	81	-1	13979	10038	52970	4.0798E+00	1.5000E+02	-4.0600E+00
(n,n*32)	82	-1	14319	10181	52981	4.1089E+00	1.5000E+02	-4.0890E+00
(n,n*33)	83	-1	14656	10429	52992	4.1330E+00	1.5000E+02	-4.1130E+00
(n,n*34)	84	-1	14990	10572	53003	4.1401E+00	1.5000E+02	-4.1200E+00
(n,n*35)	85	-1	15323	10715	53014	4.1471E+00	1.5000E+02	-4.1270E+00
(n,n*36)	86	-1	15654	10998	53025	4.1602E+00	1.5000E+02	-4.1400E+00
(n,n*37)	87	-1	15984	11211	53036	4.1803E+00	1.5000E+02	-4.1600E+00
(n,n*38)	88	-1	16313	11424	53047	4.2014E+00	1.5000E+02	-4.1810E+00
(n,n*39)	89	-1	16640	11637	53058	4.2205E+00	1.5000E+02	-4.2000E+00
(n,n*c)	91	1	16966	11780	53069	4.2305E+00	1.5000E+02	-4.2100E+00
(n,gma)	102	0	17289			1.0000E-11	1.5000E+02	7.3760E+00
(n,p)	103	0	25199			6.5618E-01	1.5000E+02	-6.5300E-01
(n,t)	105	0	26287			5.5469E+00	1.5000E+02	-5.5200E+00
(n,a)	107	0	26581			2.3446E-09	1.5000E+02	7.8880E+00
(n,xp)	203	0	34447			6.5618E-01	1.5000E+02	
(n,xd)	204	0	35535			2.0000E+01	1.5000E+02	
(n,xt)	205	0	35686			5.5469E+00	1.5000E+02	
(n,xa)	207	0	35980			2.3446E-09	1.5000E+02	
damage	444	0	43846			1.0000E-11	1.5000E+02	

Table 23: Pb-208 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldlw	emin	emax	q
elastic	2			1		1.0000E-11	1.5000E+02	
(n,x)	5	-101	1	-1	47	3.0000E+01	1.5000E+02	0.0000E+00
(n,2n)	16	-2	137	-1	9911	7.4031E+00	1.5000E+02	-7.3674E+00
(n,3n)	17	-3	354	-1	16494	1.4174E+01	1.5000E+02	-1.4106E+01
(n,n*)a	22	-1	534	-1	18808	9.9999E-01	1.5000E+02	5.1910E-01
(n,2n)a	24	-2	1675	-1	20425	7.0101E+00	1.5000E+02	-6.9763E+00
(n,n*)p	28	-1	1899	-1	20779	8.0509E+00	1.5000E+02	-8.0120E+00
(n,n*)d	32	-1	2106	-1	25065	1.2691E+01	1.5000E+02	-1.2630E+01
(n,n*)t	33	-1	2292	-1	25956	1.2938E+01	1.5000E+02	-1.2876E+01
(n,4n)	37	-4	2477	-1	26802	2.2301E+01	1.5000E+02	-2.2193E+01
(n,2np)	41	-2	2629	-1	27479	1.5000E+01	1.5000E+02	-1.4854E+01
(n,n*1)	51	-1	2806	1791	29021	2.6272E+00	1.5000E+02	-2.6146E+00
(n,n*2)	52	-1	3409	2634	29032	3.2133E+00	1.5000E+02	-3.1977E+00
(n,n*3)	53	-1	3905	3232	29043	3.4920E+00	1.5000E+02	-3.4751E+00
(n,n*4)	54	-1	4356	3795	29054	3.7264E+00	1.5000E+02	-3.7084E+00
(n,n*5)	55	-1	4773	4358	29065	3.9388E+00	1.5000E+02	-3.9198E+00
(n,n*6)	56	-1	5165	4921	29076	3.9656E+00	1.5000E+02	-3.9464E+00
(n,n*7)	57	-1	5554	5449	29087	3.9802E+00	1.5000E+02	-3.9610E+00
(n,n*8)	58	-1	5941	5977	29098	4.0151E+00	1.5000E+02	-3.9957E+00
(n,n*9)	59	-1	6326	6505	29109	4.0566E+00	1.5000E+02	-4.0370E+00
(n,n*10)	60	-1	6705	7033	29120	4.0646E+00	1.5000E+02	-4.0450E+00
(n,n*11)	61	-1	7082	7561	29131	4.0701E+00	1.5000E+02	-4.0505E+00
(n,n*12)	62	-1	7458	8089	29142	4.1052E+00	1.5000E+02	-4.0854E+00
(n,n*13)	63	-1	7827	8827	29153	4.1259E+00	1.5000E+02	-4.1060E+00

Table 23: Pb-208 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,n*14)	64	-1	8194	9355	29164	4.1453E+00	1.5000E+02	-4.1253E+00
(n,n*15)	65	-1	8559	9883	29175	4.1611E+00	1.5000E+02	-4.1410E+00
(n,n*16)	66	-1	8920	10411	29186	4.1792E+00	1.5000E+02	-4.1590E+00
(n,n*17)	67	-1	9278	10939	29197	4.2007E+00	1.5000E+02	-4.1804E+00
(n,n*18)	68	-1	9634	11467	29208	4.2258E+00	1.5000E+02	-4.2054E+00
(n,n*19)	69	-1	9986	11995	29219	4.2500E+00	1.5000E+02	-4.2295E+00
(n,n*20)	70	-1	10333	12523	29230	4.2505E+00	1.5000E+02	-4.2300E+00
(n,n*21)	71	-1	10678	13051	29241	4.2741E+00	1.5000E+02	-4.2535E+00
(n,n*22)	72	-1	11018	13579	29252	4.2831E+00	1.5000E+02	-4.2624E+00
(n,n*23)	73	-1	11354	14107	29263	4.3170E+00	1.5000E+02	-4.2962E+00
(n,n*24)	74	-1	11683	14635	29274	4.3389E+00	1.5000E+02	-4.3180E+00
(n,n*25)	75	-1	12011	15163	29285	4.3442E+00	1.5000E+02	-4.3232E+00
(n,n*26)	76	-1	12337	15901	29296	4.3796E+00	1.5000E+02	-4.3585E+00
(n,n*27)	77	-1	12661	16429	29307	4.4042E+00	1.5000E+02	-4.3829E+00
(n,n*28)	78	-1	12982	16957	29318	4.4244E+00	1.5000E+02	-4.4030E+00
(n,n*29)	79	-1	13298	17485	29329	4.4434E+00	1.5000E+02	-4.4220E+00
(n,n*30)	80	-1	13611	18223	29340	4.4656E+00	1.5000E+02	-4.4440E+00
(n,n*31)	81	-1	13921	18751	29351	4.4846E+00	1.5000E+02	-4.4630E+00
(n,n*32)	82	-1	14228	19244	29362	4.5022E+00	1.5000E+02	-4.4805E+00
(n,n*33)	83	-1	14532	19737	29373	4.5992E+00	1.5000E+02	-4.5770E+00
(n,n*34)	84	-1	14827	20230	29384	4.6324E+00	1.5000E+02	-4.6100E+00
(n,n*35)	85	-1	15118	20933	29395	4.6484E+00	1.5000E+02	-4.6260E+00
(n,n*36)	86	-1	15408	21426	29406	4.7027E+00	1.5000E+02	-4.6800E+00
(n,n*37)	87	-1	15692	21919	29417	4.7210E+00	1.5000E+02	-4.6982E+00
(n,n*38)	88	-1	15973	22622	29428	4.7338E+00	1.5000E+02	-4.7110E+00
(n,n*39)	89	-1	16250	23115	29439	4.7851E+00	1.5000E+02	-4.7620E+00
(n,n*40)	90	-1	16522	23608	29450	4.8534E+00	1.5000E+02	-4.8300E+00

Table 23: Pb-208 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,n*c)	91	-1	16789	-1	29461	4.8534E+00	1.5000E+02	-4.8300E+00
(n,gma)	102	0	17056			1.0000E-11	1.5000E+02	3.9374E+00
(n,p)	103	0	22172			4.2361E+00	1.5000E+02	-4.2156E+00
(n,d)	104	0	22521			5.8155E+00	1.5000E+02	-5.7874E+00
(n,t)	105	0	22768			6.4034E+00	1.5000E+02	-6.3725E+00
(n,a)	107	0	23005			2.4632E-08	1.5000E+02	6.1865E+00
(n,xp)	203	0	28052			4.2361E+00	1.5000E+02	
(n,xd)	204	0	28401			5.8155E+00	1.5000E+02	
(n,xt)	205	0	28648			6.4034E+00	1.5000E+02	
(n,xa)	207	0	28885			2.4632E-08	1.5000E+02	
damage	444	0	33932			1.0000E-11	1.5000E+02	
(n,p*0)	600	0	39048			4.2361E+00	1.5000E+02	-4.2156E+00
(n,p*1)	601	0	39397			4.2761E+00	1.5000E+02	-4.2555E+00
(n,p*2)	602	0	39736			4.5656E+00	1.5000E+02	-4.5436E+00
(n,p*3)	603	0	40035			4.7120E+00	1.5000E+02	-4.6892E+00
(n,p*4)	604	0	40317			4.7312E+00	1.5000E+02	-4.7083E+00
(n,p*c)	649	0	40596			4.7312E+00	1.5000E+02	-4.7083E+00
(n,d*0)	650	0	40874			5.8155E+00	1.5000E+02	-5.7874E+00
(n,d*1)	651	0	41121			6.1683E+00	1.5000E+02	-6.1385E+00
(n,d*2)	652	0	41363			7.1702E+00	1.5000E+02	-7.1355E+00
(n,d*3)	653	0	41585			7.5064E+00	1.5000E+02	-7.4701E+00
(n,d*c)	699	0	41799			7.5064E+00	1.5000E+02	-7.4701E+00
(n,t*0)	700	0	42013			6.4034E+00	1.5000E+02	-6.3725E+00
(n,t*1)	701	0	42250			6.6703E+00	1.5000E+02	-6.6381E+00
(n,t*2)	702	0	42483			6.6708E+00	1.5000E+02	-6.6386E+00
(n,t*3)	703	0	42715			6.7095E+00	1.5000E+02	-6.6771E+00
(n,t*c)	749	0	42945			6.7095E+00	1.5000E+02	-6.6771E+00

Table 23: Pb-208 Neutron Reaction Data

reaction	mt	tyr	lsig	land	lldw	emin	emax	q
(n,a*0)	800	0	43174			1.0000E-11	1.5000E+02	6.1865E+00
(n,a*1)	801	0	48290			1.0000E-11	1.5000E+02	5.8071E+00
(n,a*2)	802	0	53406			1.0000E-11	1.5000E+02	5.7175E+00
(n,a*c)	849	0	58522			1.0000E-11	1.5000E+02	5.7175E+00